



# Expand Your Vision

Embedded Intel® Architecture in  
Medical Imaging, Diagnostics and Monitoring



# Platform Solutions for Medical Imaging, Diagnostics and Monitoring

Medical equipment technology is advancing rapidly.

**Advanced medical imaging systems may need to support 3D and time-varying 4D images, multi-modal imaging, simultaneous multiple data sets, advanced rendering and modeling, automated image management, object extraction and inferencing and data mining.**

Mobile diagnostic instruments increasingly need to support the use of wireless sensors and permit hands-free control, with extended battery life and a variety of small form factors ranging from PDAs to laptops and cart-mounted equipment. Security is vital to protect confidential patient data and images.

Patient monitoring systems are now being used in a variety of settings, ranging from hospitals and clinics to ambulances and in-home applications. These systems must be capable of monitoring multiple parameters and include specialized equipment, from anesthesia monitors and external defibrillators to pulse oximeters and ECG monitors.

While each innovation provides exciting new capabilities, this non-stop technology evolution imposes new demands on networked medical devices that must handle increasing data workloads, demanding applications and security algorithms.

Meeting these increasingly stringent requirements requires an embedded platform approach that can deliver high performance, low power consumption and scalability for the long term. Intel's medical platform

vision is based on a new multi-core microarchitecture for embedded processors. The benefits include a new level of design flexibility based on scalable embedded hardware building blocks and software reuse for lower total cost of ownership.

Intel® Core™ microarchitecture lets you design both fixed and portable medical systems at multiple levels of integration using a common processor core. In addition to energy-efficient performance, these processors deliver the enhanced performance and reliability of advanced Intel platform technologies including Intel® Active Management Technology, Intel® I/O Acceleration Technology, Intel® Extended Memory 64 Technology and Intel® Virtualization Technology.

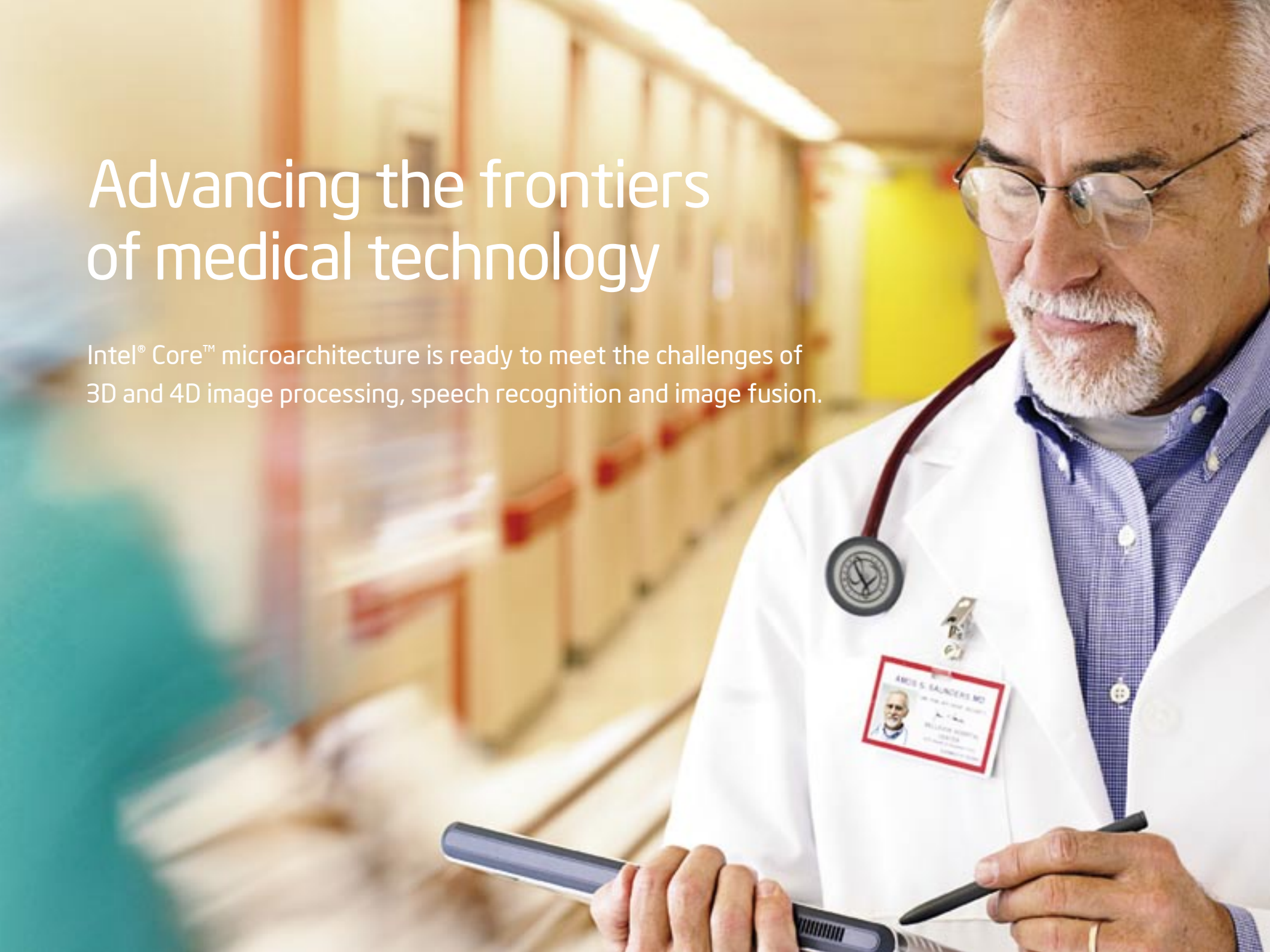
Intel backs its embedded lifecycle product roadmap with the technical support and tools you need to reduce time-to-market and development cost, backed by an ecosystem of leading hardware and software solutions vendors.

**Expand your vision of medical platform solutions.  
Intel is focused on your requirements.**



# Advancing the frontiers of medical technology

Intel® Core™ microarchitecture is ready to meet the challenges of 3D and 4D image processing, speech recognition and image fusion.





## Scalable Performance and Headroom with Embedded Lifecycle Support

### Intel® Core™ Microarchitecture

Intel Core microarchitecture includes innovative features that deliver scalable energy efficient performance for medical devices:

Intel® Wide Dynamic Execution delivers more instructions per clock cycle to improve execution time and energy efficiency. The processor's execution cores can fetch, dispatch, execute and retire up to four full instructions simultaneously. Deeper buffers optimize the effective number of instructions in use relative to the pipeline.

Intel® Intelligent Power Capability optimizes the runtime power consumption of processor execution cores. Extensive use of power gating means that devices are only powered on when they are needed. This results in lower

TDP and average power. Split buses and arrays enable data required in some modes of operation to be put in a low power state when not needed.

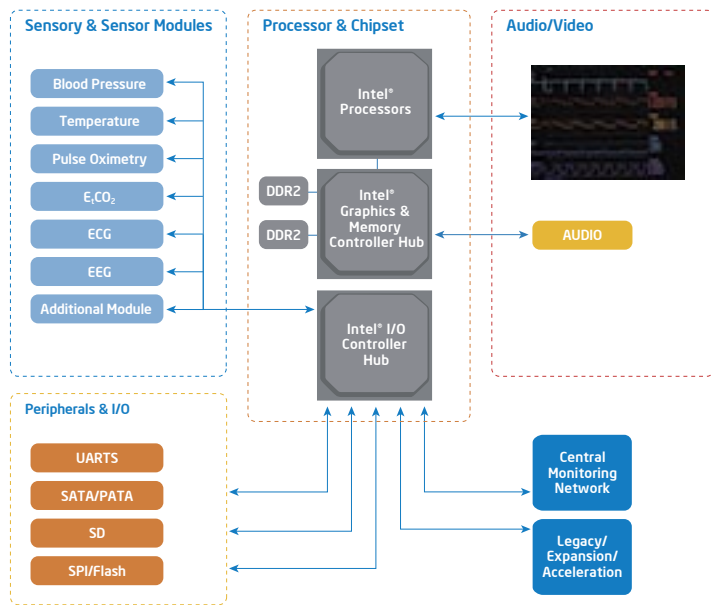
Intel® Advanced Smart Cache is a large, shared, multi-core optimized cache that significantly reduces latency to access frequently used data, improving performance and efficiency.

Intel® Advanced Digital Media Boost significantly improves performance when executing instructions that accelerate applications including video, speech and image recognition, and data encryption.

Intel Core microarchitecture provides the combination of responsive performance and energy efficiency you need for powerful, easy to use, ultra-quiet medical platform designs.

# Intel® Architecture Addresses Applications Ranging From Imaging to Patient Monitoring

## Patient Monitoring

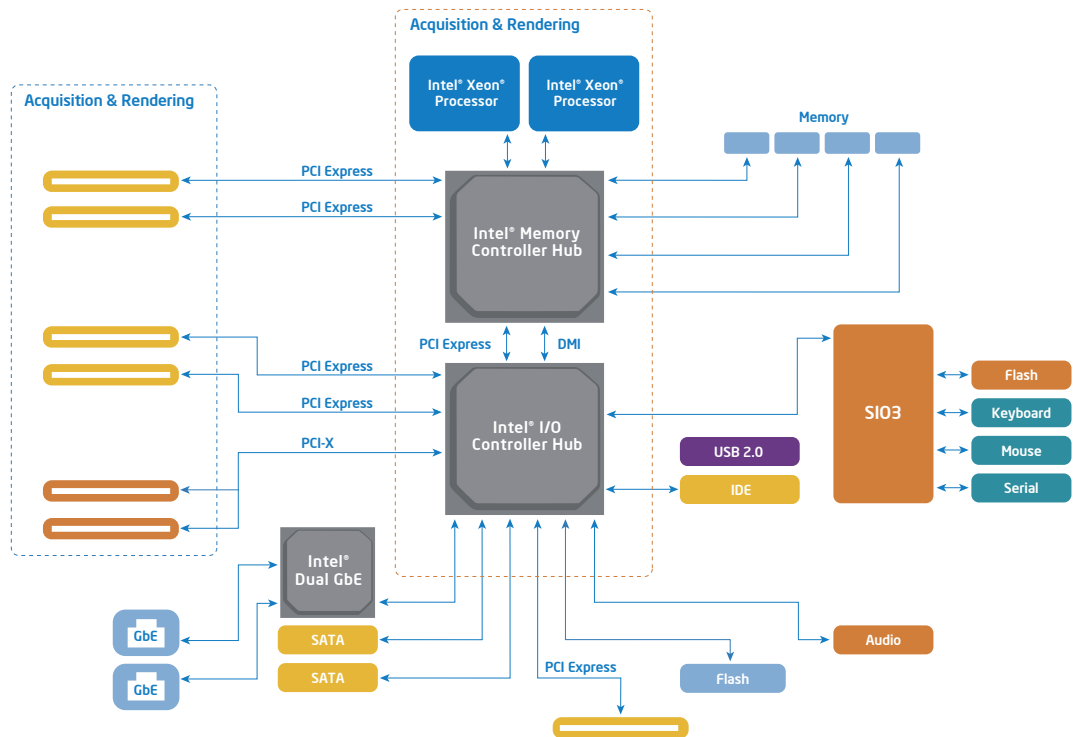


### Benefits of Intel's embedded platform architecture



Validated combinations of embedded Intel® multi-core processors and Intel® chipsets provide a consistent platform architecture that spans a range of requirements including high performance, low power and reduced cost. Intel embedded products are supported for a minimum of 5-7 years.

## Medical Imaging



## Fast, High Quality Medical Imaging, Diagnostics and Monitoring

### Energy Efficient Performance

Intel is introducing a common energy-efficient core across a range of processor product lines – a platform approach that enables you to optimize your code for one core and then apply it to a range of processors. Because the processor core is highly code-efficient, code optimization may not be needed for many medical imaging applications.

### Dual-Core Intel® Xeon® Processor 5100 Series

I/O bandwidth and performance for high-end systems

Benchmarks (SPECint\_2000-Rate - DP mode) conducted by Intel compare the system performance of two Dual-Core Intel Xeon processors 5140 (2.33 GHz) in a dual-processing configuration (four cores per system) with two single-core Intel Xeon processors (2.8 GHz) in a dual-processing configuration (two cores per system). Results show a greater than 3x performance improvement (24.3 to 89.8) due to enhancements to the core, increased front-side bus speed and advanced platform technologies. In another industry-



standard benchmark (SPECfp\_2000-Rate - DP mode), the 2.33 GHz dual-core processor-based system demonstrates almost a 4x performance improvement (17.3 to 67.5) compared to the 2.8 GHz single-core processor-based system<sup>1</sup>. Advances in memory, I/O and reliability help optimize the platform for the demands of multi-core processing and virtualization environments.

This high-performance processor is ready to handle the workloads of compute and I/O-intensive medical systems. Intel® Advanced Smart Cache significantly reduces bus traffic, for improved performance. In imaging applications, the processor provides the bandwidth and computational power you need to process complex algorithms, 3D and 4D images and image fusion. It is especially suited to applications that involve the merger of multiple medical image data sets from MRI, PET, CT, Ultrasound, Digital Radiography and other sources to create information-rich visualizations.

Dual-core processing provides significant performance headroom which can significantly accelerate image generation, while optimizing visual quality:

- Increased I/O bandwidth for high performance storage arrays
- Fully buffered DIMM memory enhances DRAM capacity and memory bandwidth
- Higher bandwidth and reduced CPU- to-memory latency under heavy data loading speeds random lookups

### Intel® Core™2 Duo Processor

Energy efficient performance for portable devices

The Intel® Core™2 Duo processor provides two energy-efficient, mobile-optimized execution cores in a single processor. This processor is an ideal choice for lightweight portable imaging, diagnostic and monitoring devices that require processors with a combination of high performance and thermal efficiency.



Performance features include up to 4 MB of Intel® Advanced Smart Cache, Intel® EM64T Technology for 64-bit computing, and Intel® Advanced Digital Media Boost for improved graphics and multi-media performance.

Intel is applying a common processor core across server, mobile and scalable product families. Here are the benefits:

- ☐ Energy-efficient performance is now available, top-to-bottom, across a broad range of medical device applications
- ☐ Software developers can optimize code for one core and then apply it to a range of processors
- ☐ Developers can create a single code source around Intel technologies that enable 64-bit processing, virtualization and enhanced security



# Innovations in digital technology place new power in your hands

Advanced platform technologies from Intel are redefining the future of medical imaging, monitoring and diagnostics.





### **Intel® Communications Alliance**

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The Intel® Communications Alliance is your single point of entry to a trusted supply line of solutions for medical applications.

Member companies have the expertise to deliver high-volume embedded computing, communications and interconnect solutions based on Intel products and technologies.

You benefit from non-stop innovation, a choice of best-in-class products, economies of scale and extensive R&D investments.

[www.intel.com/go/ica](http://www.intel.com/go/ica)

## **Intel Technologies Enhance Performance, Networking, Manageability and Reliability**

Embedded Intel® architecture platform solutions enable continuous improvements in the performance of medical devices.

### **Intel® I/O Acceleration Technology<sup>2</sup>**

Intel® I/O Acceleration Technology (Intel® I/OAT) takes a platform approach to network traffic optimization by breaking up data-handling among multiple platform components, including the processor, chipset, network controller and software. This distribution approach reduces the workload on the processor while accelerating data flow.

### **Intel® Active Management Technology<sup>3</sup>**

Intel® Active Management Technology (Intel® AMT) enables IT staff to remotely access networked computing systems—even systems that are turned off or that lack a working operating system or hard drive.

### **Intel® Virtualization Technology<sup>4</sup>**

Intel® Virtualization Technology enables a single hardware platform to function as multiple manageable and scalable “virtual” platforms. The technology enhances system reliability by enabling failover to the virtual platform. Software isolation protects the code base.

### **Intel® Extended Memory 64 Technology<sup>5</sup>**

Intel® Extended Memory 64 Technology (Intel® EM64T) enables the processor to run 64-bit code and access larger amounts of memory than 32-bit code. With appropriate Intel EM64T-supporting hardware and software, platforms can use a combination of extended virtual memory and physical memory.

### **Intel® Software Development Products**

To get the most out of multi-core technology, you must thread your software to enable the operating system to divide work among multiple processor cores. Standards-compliant Intel® Software Development Products, including Intel® Compilers, Intel® VTune™ Performance Analyzers, Intel® Performance Libraries and Intel® Threading Tools help you add threading and optimize performance.

The Intel® Software Library contains video, imaging, cryptography, and signal processing and codec functions needed for medical imaging, diagnostics and monitoring applications.

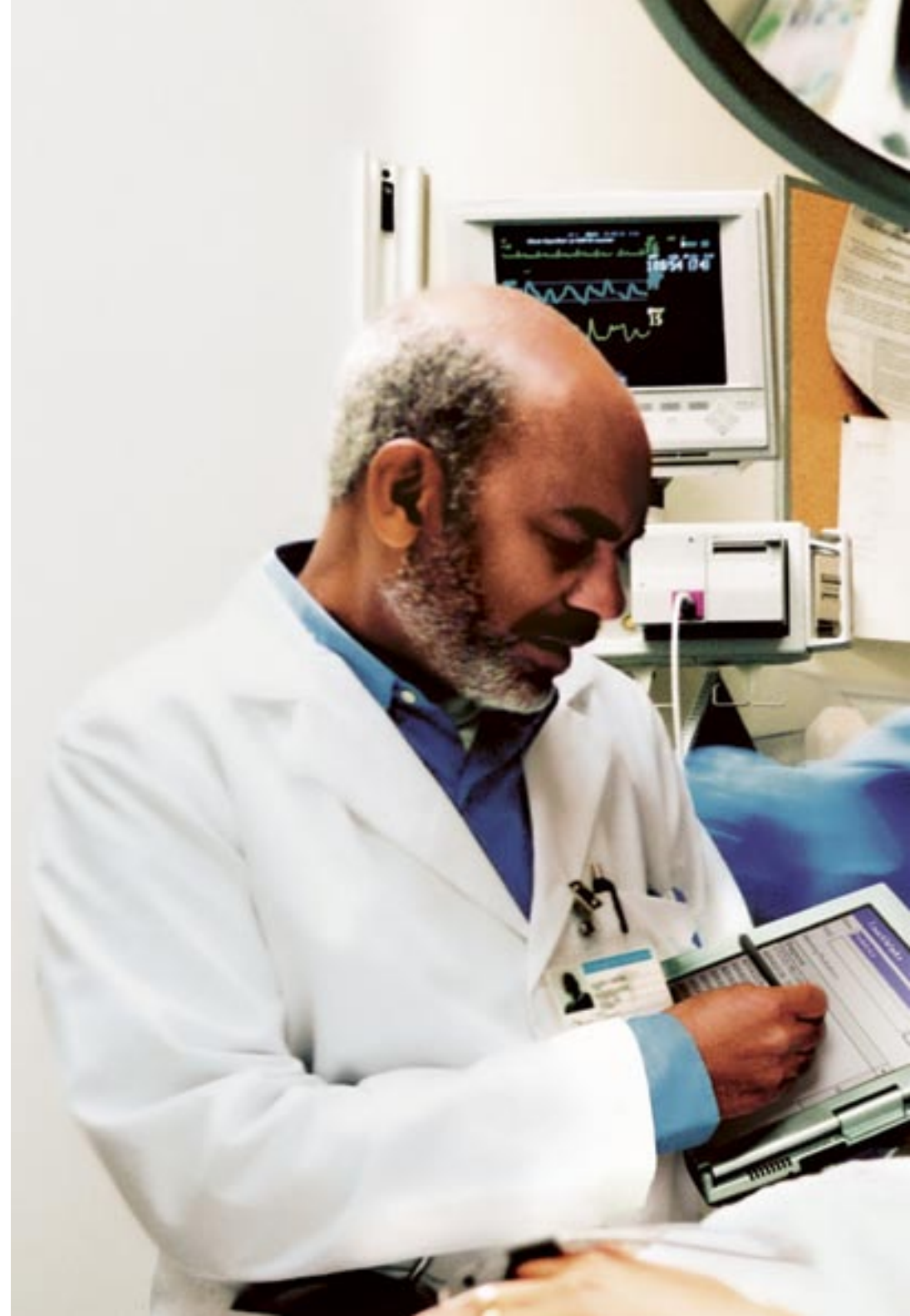
## Intel is Focused on Your Requirements

Intel is focused on meeting your medical platform requirements by providing scalable, validated platform solutions designed to optimize your design flexibility, minimize total cost of ownership and accelerate time-to-market.

Embedded Intel® architecture platform solutions provide the advantages of modularity, conformance with industry standards and software reuse.

When you base your designs on Intel's broad product portfolio and embedded roadmap, you get the added benefits of professional technical support, Intel's dedicated global sales organization and an extensive ecosystem of leading embedded hardware and software solutions vendors.

Expand your vision of medical platform solutions with embedded Intel architecture.

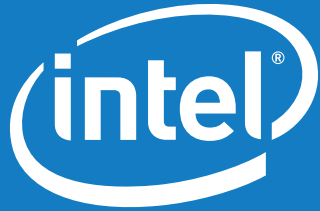




# Expand Your Vision

For information, contact your  
Intel representative, or visit us online:

[www.intel.com/go/embedded](http://www.intel.com/go/embedded) →



[www.intel.com/go/embedded](http://www.intel.com/go/embedded)

<sup>1</sup> Benchmarking results collected by Intel Corporation, April 2006.

Configurations:

- Two 2.33 GHz Dual-Core Intel® Xeon® processors 5140 with Intel® 5000P chipset, 1333 MHz FSB, and 4x1 GB dual-rank 667 MHz FB-DIMM DDR2 (Dual-Core Intel® Xeon® processor 5140 with Intel® 5000P chipset development kit). Software: Linux® RedHat 9.0, Kernel 2.6.9-22.EL, 32-bit & 64-bit OS, Intel® Compiler 9.0
- Two 64-bit Intel® Xeon® processors 2.8 GHz with 800 MHz system bus with Intel® E7520 chipset, 800 MHz FSB, and 1GB DDR2 400 MHz. (Intel® Xeon® Processor with 800 MHz System Bus, Intel® E7520 Chipset, and Intel® 6300ESB I/O Controller Hub Development Kit) Software: Linux RedHat 9.0, Kernel 2.6.9-22.EL, 32-bit OS, Intel Compiler 9.0

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit <http://www.intel.com/performance/resources/limits.htm>.

SPEC® benchmark tests reflect the performance of the microprocessor, memory architecture and compiler of a computer system on compute-intensive, 32-bit applications. SPEC benchmark tests results for Intel microprocessors are determined using particular, well-configured systems. These results may or may not reflect the relative performance of the Intel microprocessor in systems with different hardware or software designs or configurations (including compilers). Buyers should consult other sources of information, including system benchmarks, to evaluate the performance of systems they are considering purchasing. For more information about STREAM Benchmark, including a description of the systems used to obtain

these test result, and other information about microprocessor and system performance and benchmarks, visit Intel's World Wide Web Site <http://www.intel.com/> or call 1-800-628-8686.

<sup>2</sup> Intel® I/O Acceleration Technology (Intel® I/OAT) requires an operating system that supports Intel I/OAT. Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See [http://www.intel.com/products/processor\\_number](http://www.intel.com/products/processor_number) for details.

<sup>3</sup> Intel® Active Management Technology requires the platform to have an Intel® AMT-enabled chipset, network hardware and software. The platform must also be connected to a power source and an active LAN port.

<sup>4</sup> Intel® Virtualization Technology requires a computer system with a processor, chipset, BIOS, virtual machine monitor (VMM) and applications enabled for virtualization technology. Functionality, performance or other virtualization technology benefits will vary depending on hardware and software configurations. Virtualization technology-enabled BIOS and VMM applications are currently in development.

<sup>5</sup> Intel® EM64T requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel EM64T. Processor will not operate (including 32-bit operation) without an Intel EM64T-enabled BIOS. Performance will vary depending on your hardware and software configurations. See [www.intel.com/info/em64t](http://www.intel.com/info/em64t) for more information including details on which processors support Intel EM64T or consult with your system vendor for more information.

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